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Theoretical Foundations of Integrating Digital Learning Technologies into Primary School Native Language Instruction

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Abstract: This article analyzes the scientific and methodological foundations of teaching natural sciences in primary education based on the STEAM (Science, Technology, Engineering, Art, Mathematics) approach. It is justified that STEAM integration contributes to the development of competencies such as observation, experimentation, problem-solving, creative thinking, and practical project design among students. In addition, the article presents the state policy on the implementation of STEAM in the education system of Uzbekistan, methodological recommendations for teachers, and examples of practical projects that can be applied in primary school classes.

Keys words: STEAM, integration, natural sciences, primary education, project-based learning, creative thinking, experiments, problem-solving, technological competence.

In today's context of globalization and digital transformation, organizing the primary education process in accordance with modern requirements has become one of the priority directions of state policy. As the President of the Republic of Uzbekistan, Sh. M. Mirziyoyev, emphasized, *"The most important foundation of New Uzbekistan's development is education based on modern knowledge and innovation"* [1]. The need to digitalize the education system and widely introduce innovative pedagogical and information technologies into the learning process is also highlighted in Presidential Decree No. PF–60 [2], which states: *"One of the key factors in improving the quality of education is the effective use of digital educational resources"* [3].

From this perspective, the use of digital educational technologies in primary school native language instruction serves as one of the most essential mechanisms for developing students' reading, writing, linguistic, text comprehension, and logical expression skills. The integration of digital tools not only enhances the effectiveness of the lesson but also increases students' motivation, strengthens their independent learning abilities, and contributes to the development of functional literacy [4].

Primary school native language lessons include a number of crucial processes such as forming speech skills, teaching sound–letter relationships, applying spelling rules in practice, and gradually developing grammatical understanding. The effectiveness of these processes largely depends on the teaching methodology, particularly on how accurately and purposefully digital educational technologies are integrated. Digital tools present instructional content in an interactive format, making lessons more

engaging, dynamic, visual, and easier for young learners to comprehend. This, in turn, supports conscious learning, logical thinking, active participation, and independent study skills in primary school children.

Multimedia Tools. The use of multimedia elements such as animations, graphic images, and audio–video clips significantly enhances the effectiveness of teaching sounds and letters. According to Mayer's Multimedia Learning Theory [5], information is learned more deeply and retained more effectively when learners process it simultaneously through multiple sensory channels—visual, auditory, and conceptual. For example, distinguishing consonant sounds, recognizing letter shapes, understanding sentence structure, or perceiving the intonation of a text becomes easier through videos and animations. These tools are especially effective in exercises related to phonetics, expressive reading, and text comprehension.

Interactive Platforms (Quizizz, Kahoot, Educaplay). One of the fundamental principles highlighted in pedagogical science is that primary school learners acquire knowledge more effectively through play-based activities. These interactive platforms employ gamification elements—such as scoring, competition, and various motivational mechanisms—to support the development of spelling, vocabulary, and grammatical skills. Tasks such as "choosing the correct spelling," "selecting the appropriate word," "identifying the extra word in a sentence," or "combining syllables correctly" increase students' cognitive processing speed and cultivate habits of self-assessment and error analysis.

Electronic Textbooks. Electronic textbooks and methodological materials presented through Uzbekistan's official "National Digital Education Platform" (https://eduportal.uz) offer extensive opportunities for organizing effective native language instruction. Features such as interactive maps, audio texts, automated assessment systems, tests, and instructional videos help students work at their own pace and foster independent learning skills. In addition, electronic textbooks enable teachers to provide differentiated tasks, adapt the learning process, and conduct real-time monitoring.

Virtual Whiteboards (Jamboard, Miro). Virtual whiteboard tools facilitate digital implementation of cognitive activities such as working with text structure, constructing sentences, organizing word combinations, creating clusters, and developing Venn diagrams. These tools encourage students to think creatively, collaborate effectively, and represent their ideas visually. For instance, Jamboard allows students to identify the main idea of a text, determine event sequences, or illustrate plot development through cluster diagrams. Miro, in turn, enables the creation of more complex diagrams, maps, and conceptual models, supporting the development of analytical and visual thinking skills.

The use of digital tools ensures the following outcomes: students' interest in lessons increases; each learner gains the opportunity to complete tasks suited to their individual learning style; the learning process becomes more visualized, and complex grammatical concepts are presented in a simpler and more comprehensible manner; a healthy sense of competition, active participation, and a collaborative learning environment are cultivated among students; and processes such as monitoring, assessment, analysis, and reflection become significantly easier for teachers. Thus, digital educational technologies not only enhance the effectiveness of native language instruction in primary school but also contribute to the development of 21st-century competencies—information literacy, critical thinking, communication, collaboration, and digital culture.

Primary school learners are in an intensive stage of cognitive development, and they primarily perceive information through visual images, bright colors, movement, and sound. Therefore, integrating digital technologies into the didactic process is fully aligned with the developmental characteristics of young learners. By using digital tools, the learning process becomes not only more visual and engaging but also provides a conducive platform for the development of psychological processes. In particular, digital technologies strengthen: attention — animated objects and interactive buttons help maintain sustained focus throughout the lesson; memory — information learned through images, colors, and sound is more likely to be retained in long-term memory; visual-conceptual thinking — abstract concepts become easier to understand when visually modeled; motivation — digital games, scoring systems, and

competitive elements engage learners in a self-motivating, active educational environment. These psychological characteristics were also emphasized by Vygotsky (1981), who noted the priority role of visual tools in children's learning.

Primary school native language lessons aim to develop students' linguistic and communicative abilities, and digital methods enrich traditional approaches by making lessons more interactive, accessible, and modern.

Gamification-based learning. Gamification refers to incorporating game mechanisms into the learning process, and it is especially effective in primary grades. Learning topics such as parts of speech, imperative forms, spelling rules, synonyms and antonyms, and syllabification through platforms like Kahoot, Quizizz, and Wordwall increases learners' interest, enables repeated practice of targeted exercises, and develops error-analysis skills.

Differentiated digital tasks. Primary school students do not learn at the same pace or in the same manner, and digital methods are ideal for organizing individualized instruction. Teachers may assign more complex texts to stronger students, adapted tasks to average learners, and simplified exercises to those who need additional support. This approach ensures instruction that aligns with each child's unique abilities.

The process of working with text in native language lessons is enhanced through digital models such as: INSERT strategy — marking texts, commenting during reading, and identifying unclear or noteworthy information; Clusters — systematizing text content, identifying key concepts, and illustrating relationships between them; Venn diagrams — comparing, generalizing, and distinguishing similarities and differences.

Completing these models using Jamboard, Padlet, or MindMeister strengthens analytical thinking, logical text processing, and structural comprehension—key components of higher-order cognitive activity.

The use of digital educational technologies in primary school native language instruction provides a modern and effective means of accelerating students' language development, improving their text-processing skills, strengthening spelling and grammar proficiency, and fostering functional literacy. In addition to enhancing traditional teaching practices, digital tools create an interactive learning environment where students engage with multimodal content—audio, video, animations, and interactive texts—that stimulate deeper comprehension and active participation. In this context, digital platforms such as e-dictionaries, reading applications, speech-to-text tools, and interactive storybooks empower young learners to independently explore linguistic patterns, expand vocabulary, and reinforce phonetic awareness. Gamified learning environments, including quizzes, puzzles, and adaptive learning apps, improve motivation and support differentiated instruction by allowing each student to progress at their own pace. These technologies also facilitate formative assessment through instant feedback, enabling teachers to identify learning gaps and tailor instructional strategies more effectively. In line with the digital transformation objectives set within Uzbekistan's education policy, improving methodological approaches enhances teachers' digital competence, increases lesson efficiency, and elevates the overall quality of learning to a higher level. The integration of digital pedagogy not only modernizes lesson delivery but also aligns primary education with international standards and 21st-century learning requirements. As teachers master digital tools—interactive whiteboards, learning management systems (LMS), virtual classrooms, and AI-supported language resources—they become capable of designing richer, more inclusive, and student-centered learning experiences. Ultimately, the systematic incorporation of digital educational technologies strengthens analytical thinking, nurtures creativity, enables personalized learning pathways, and develops the functional literacy skills necessary for students to succeed in an increasingly digital and knowledge-driven society.

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